

Effectiveness of GSDL Model on Attitudes Toward Mathematics in Basic School of Nepal

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Abstract

This study aims to find effectiveness of a Guided Self-Directed Instructional Model on Students attitude toward learning mathematics. Guided by positivist philosophical, we had employed experimental research design with innovative guided self-directed instructional learning model designed by Pokhrel (2026) in mathematics class. This model thus employs specific instructional strategies in a structured, progressive set of stages to transform a teacher-dependent learner to self-directed learner. The GSDL model was implemented in two groups of grade eight student in basic schools one was public and the other was private consisted of 56 students. Effectiveness of the GSDL was using the Students' attitudes toward mathematics scale. IBM SPSS Version 26 was used to analyze quantitative data. The result concludes that students in both school private and public had unfavorable attitude toward mathematics in pretest result but improved favorable attitude after GSDL intervention. There was significance difference of mean attitude toward mathematics between pre and post test result, showed that GSDL intervention had positive effect on student's overall attitudes toward mathematic in both private and public school. Moreover, showed that GSDL model was equally effective in improving attitudes toward mathematics in both private and public school. It can be concluded that the structured stage base GSDL instructional model shifts the pedagogical approach from teacher-directed to student-directed learning in the given stages of learning for improving mathematic achievement.

Keywords: Mathematics, student attitudes, effectiveness, Guided self-directed learning

Introduction

Mathematics has played a pivotal role in the evolutionary development of science and technology. Beyond its significant contribution to these fields, it is equally essential for everyday life. As a result, mathematics is universally recognized as a core subject in education, from primary school to higher education, to provide foundational knowledge for further study and practical application in daily activities (Pokhrel & Poudel, 2024). The universality of mathematics as a foundational tool across various disciplines is widely acknowledged, and mathematician Carl Friedrich Gauss metaphorically referred to mathematics as the queen of all sciences (Johns, 1998). The acquisition of mathematical proficiency is instrumental in enhancing students' performance in interdisciplinary studies (Kusmaryono, 2014). Despite the crucial role that mathematics plays in both academic and behavioral contexts, many students perceive it as a difficult, tedious and challenging subject (Yadav, 2017). This perception is observed with students in all levels accounting the indifference towards learning mathematics, a significant concern in education worldwide. (Pandit, 2007).

Mathematics is taken as one of the challenging subjects for its scholars. Teachers often search for the suitable pedagogical approaches. So the students can stimulate their thinking, and promote meaningful understanding of mathematical concepts. A single method of instruction may not be sufficient to address all the learning needs of all students. Beyond solving the problems, mathematics instruction plays a vital role in practicing critical thinking and self-directed learning. These aims as an aggregate, should be incorporated into pedagogical content and instructional strategies (Bishara, 2021). In Nepal's context, many students struggle to understand mathematical concepts and find its solution. National data of Nepal, consistently shows high failure rates due to lower scores in mathematics (Khanal, 2015; MOE, 2015). Chapagain (2020) show that 60% of students had not results in mathematics, despite better performance in others. Students are indifferent toward learning mathematics because of mathematics anxiety, lack of interest, low self-efficacy, inadequate parental support and non-professional teachers, traditional teaching methods, outdated curricula, poor physical infrastructure, and bad "math myths" (Pokhrel, 2021). These factors contribute in learning and teaching difficulties, particularly when there is a lack of coherence between the teacher's instructional methods and the students' learning processes (Khanal, 2015). The students perceive mathematics tedious subject with limited practical relevance (Shrestha et al.; 2021). Tutoring strategies significantly influence students' achievement and attitudes toward mathematics. Hence it is necessary to find an alternative instructional approaches, facilitating both the students and the teacher. The self-directed learning, involves learners identifying their learning needs, setting goals, selecting resources, and evaluating outcomes (Knowles; 1975). Similarly, self-directed learning (SDL) is a process in which learners take responsibility for organizing, implementing, and evaluating their own educational experiences (Merriam et al., 2007). Rather than being a fixed learning style applied in every situation, SDL is a developmental process through which learners gradually progress toward autonomy (Grow, 1991). This process involves various instructional strategies and learner engagement techniques, including self-organization, individual responsibility, goal-setting, choice of learning methods and self-evaluation, all contributing to meaningful learning.

Several scholars, such as Houle (1961), Tough (1971), Knowles (1971), Shinkareva (2006), Bouchard (2009), and Grow (1991), have advocated for SDL, particularly in the context of adult education. They argue that adult learners tend to be goal-oriented and actively engaged in their learning processes. Various SDL models developed by Long (1989), Candy (1991), Brockett and Hiemstra (1991), Garrison (1997), and Oswalts (2003) also focus primarily on adult learners. In this context, no prior research has investigated the application of SDL in school-level mathematics with a modified model adapted from adult education frameworks.

Recently, (Pokhrel, 2026) design and implement a new SDL model, referred to as the Guided Self-Directed Learning (GSDL) approach, specifically designed for mathematics learning. This GSDL instructional model happens through a guided and gradual process where learning shifts from teacher directed to students directed based on component and progressive stage of implemented GSDL model. Moreover, Learning happens when students feel ownership of their goals, actively track and adjust their progress, organize themselves to overcome challenges, and are empowered by an environment that supports exploration and responsibility. This model mainly based on strategic stages of instruction such as preparatory, skill gain, engagement and committed where cognitive development is influenced as students' progress through stage (Pokhrel,2026). The stages of GSDL model are hierarchical and linear because students move step by step through each stages and build on knowledge, skills and habits for student's engagement and autonomy. Now, this study to find effectiveness newly design GSDL model by (Pokhrel, 2026) on attitude toward mathematics at basic school.

Literature review

In context of the guided self-directed learning, Pokhrel et al. (2025) has identified several factors that influences the learning process. The prime position is occupied by the teacher or the facilitator, who is the designer of the whole learning outcomes. The next chapter will be obviously being the student who is aimed at learning. The third factor remains the learning environment. We now discuss about these roles of these factors.

Role of the Self-Directed Teacher

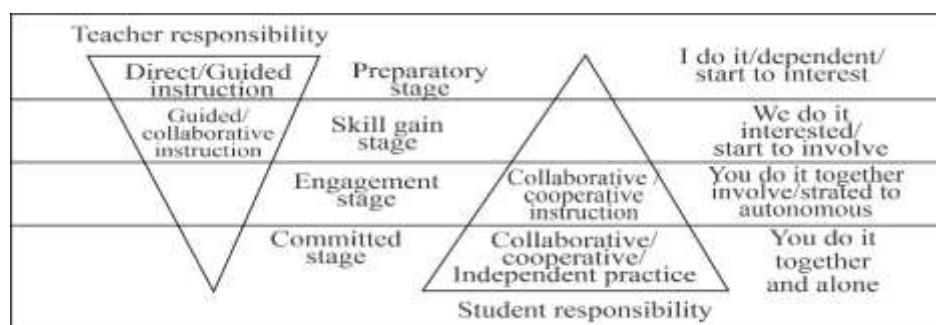
Self-directed learning (SDL) encourages students to actively engage in the learning process and develop higher-order thinking skills such as problem-solving, critical thinking, and reasoning (Bosch & Laubscher, 2019). A self-directed teacher plays a crucial role in fostering these skills, as well as in cultivating positive attitudes and a sense of independence related to learning. According to Hiemstra (1994), self-directed teachers engage in key practices such as engaging in dialogue with learners, securing learning resources, evaluating outcomes, and promoting critical thinking. Thus, a self-directed teacher serves as a motivator, facilitator, and learning manager. SDL is a meaningful and effective process in the education system, and teachers play a vital role in guiding students' transition from teacher-directed to self-directed learning. This transition requires teachers to assess students' readiness for SDL, define the scope of student autonomy, and teach appropriate learning methodologies (Iwasiw, 1987). In the referred GSDL model teacher role was guided in all stages gradually shifts coach, motivator, facilitator and consular respectively based on student goal setting and learning agreement.

Role of Self-Directed Learners

Self-directed learners (SDL) must actively engage in self-motivation, planning, monitoring, and evaluation in order to achieve meaningful learning goals (Oswalt, 2003). However, such skills often require training at the school level, as students, unlike adult learners, are typically not intrinsically self-motivated. Teachers, therefore, play a crucial role in guiding students through the development of self-motivation, self-planning, monitoring, and self-evaluation strategies necessary for effective learning. According to Ellis (2011), self-directed learners take initiative and assume responsibility for the planning, implementation, and evaluation of their work. This directly correlates with their ability to manage and direct their learning processes. Askin and Denirel (2018) define a self-directed learner as someone who sets clear goals, structures their learning based on real-life applications, evaluates outcomes independently, and demonstrates autonomy, motivation, curiosity, and a strong desire to learn. They also exhibit self-control and a willingness to assist others. In design GSDL model developed by Pokhrel (2026), student's roles were dependent, interested, involved, engaged respectively with respect to respective structural stage.

Figure 1:

Conceptualizations of Role of Self-Directed Learner and Teacher for GSDL



Sources (Pokhrel, 2026)

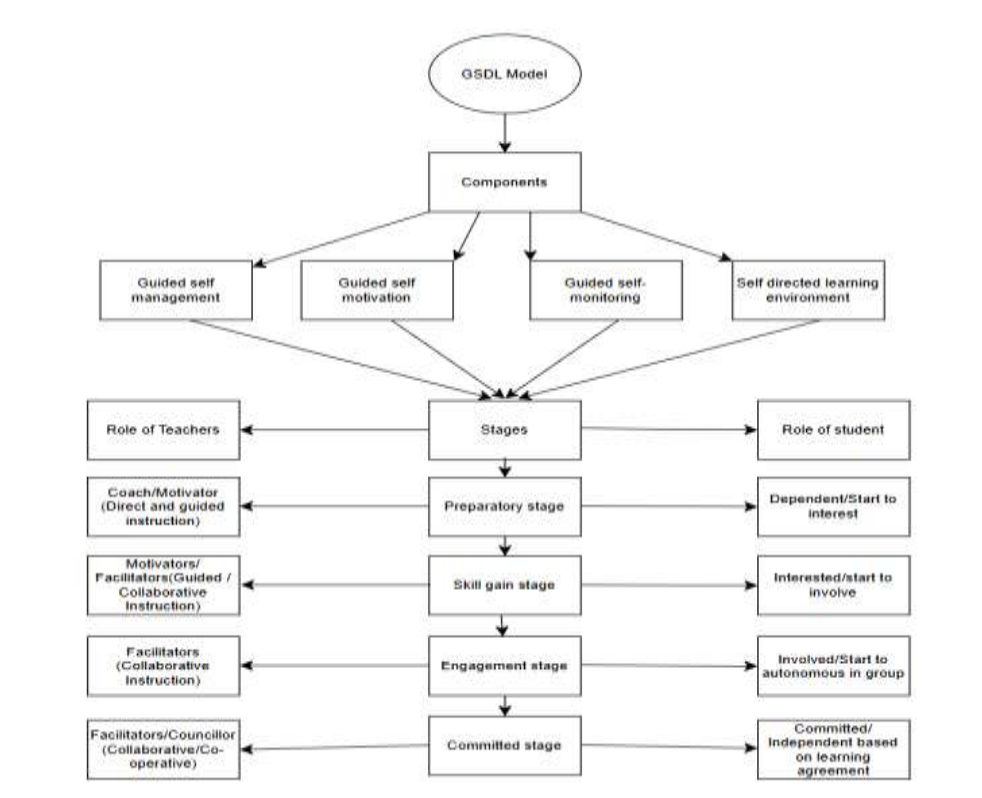
We have used GSDL instructional model designed by (Pokhrel ,2026). The conceptual implemented model was explained flows.

Implemented GSDL Model

The guided self-directed learning GSDL is blended instructional and learning model grounded in engaged learning pedagogy focus on a shift from teacher directed to student's directed under the guidance of a teacher. This model integrates the structured components such as guided self-motivation, guided self-management, guided self-monitoring, and the creation of a self-directed learning environment under progressive stage preparatory, skill gain engagement and commitment. This model mainly learner centered instructional model because it gives structure of component, stage, strategy, lesson design and teacher students interaction in the process of guided self-directed learning. It is a learning model based on learning theories, how students move from dependent learner to autonomous based on its components and internalize the learning progression inside the leaner mind. Furthermore, the philosophical roots of guided self-directed learning model encompass the blending of humanism, constructivism and pragmatism focus some epistemological assumption like learning is

developed through nature and experience, knowledge is constructed through collaboration and cooperation in peer and group; learner are rational being driven by innate curiosity and personal meaning making. The GSDL model is connected with the learning theories; behaviorism, cognitivism and constructivism. In this model, behaviorism aspect focus on structured foundation through teacher guidance and the model integrate behaviorist principle during preparatory stage through direct instruction. Similarly, cognitivism focus on developing thinking skills through guided and collaborative approach in the engagement stage.

Figure 2



Source: Pokhrel (2026)

Goal setting, promoting reflection, using collaborative strategy, self-evaluation rubric is based on cognitivism learning theory to prepare a learner for engagement and autonomy. Similarly, it is guided by constructivism learning theory adopting engage and autonomy through cooperative learning, prior knowledge integration, reflective thinking, metacognitive thinking, self-management, self-monitoring and intrinsic motivation, used in engagement stage and committed stage of GSDL model. GSDL model was linear form preparatory stage to committed stage. In stages of GSDL learning, Teacher’s responsibility gradually decreases whereas, student’s responsibility gradually increases for autonomous learning (Pokhrel ,2026). In this model, teacher follows a sequence of instruction such as direct instruction, guided instruction, collaborative and cooperative instruction. Implemented model is based on learning activity of the Nepalese students and each stage gives the foundation for next step on readiness rubric or stage progression check list. It consists of four progressive scaffolder stage; strong guidance and gradually reduced role of teacher, collaborative learning environment, and development of learner’s autonomy. The components are guided by self-motivation, self-

monitoring, self-management and SDL supportive learning environment into every stage of the learning process as given in figure 2.

Objective of the Study

The objective of the research is examining the effectiveness of a guided self-directed instructional model on student's attitudes toward mathematics.

Research Questions

This study aimed to evaluate the effectiveness of the Guided Self-Directed Learning (GSDL) approach for teaching mathematics achievements in basic-level schools. Based on objectives flowing research questions.

1. Is there a significance difference between pre and post student's attitudes toward mathematics in the experiment group in private school?
2. Is there a significance difference between pre and post student's attitudes toward mathematics in the experiment group in public school?
3. Is there a significance difference between private and public student's attitudes toward mathematics in the experiment group?

Delimitation of the study

The sample for this study was drawn from both public and private schools located in Ward No. 1 of Pokhara Metropolitan City. However, the scope of the research was confined to only two basic school's types; public and private. These were selected for the purpose of the study. This study was framed strictly by the formulated research questions formulated and did not extend beyond them. It specifically focused on Grade Eight students, excluding learners from other grades and educational levels to maintain consistency and relevance. An experimental research design was employed to conduct the study. For the data collection, adopted tools were used, including a Attitudes toward Mathematics Scale and designed instruction model developed by Pokhrel (2026). These instruments were administered during both the pre-test and post-test phases to measure changes in students' performance and attitudes.

Methodology

The research methodology used in this research was quantitative design flowing positivist philosophical paradigm. Result analysis was in SPSS software based on descriptive and inferential statistics. In this study, we had employed a quantitative research approach using an experimental design to examine the effect of Guided Self-Directed Learning (GSDL) on students' attitude toward mathematics. In this study, data was collected from mathematics attitude scales under the guided self-directed learning techniques defined by Pokhrel (2026).

Population and Sample

This study is a form of experimental research design and aimed to analyze the effect of GSDL model on mathematics attitudes in school level. The population for this research includes all students of grade eight enrolled in basic schools located in Pokhara metropolitan city. The sample of the study were purposefully selected to facilitate the implementation of the intervention. Specifically, one private and public schools from the Pokhara Metropolitan City (Ward no 1) were chosen. Purposeful sampling was used to ensure practical access and the ability to implement the intervention effectively. As Maxwell (1996) notes, it is advisable to select research sites that are easily accessible. A critical aspect of quasi-experimental research is the use of pre-tests and post-tests quasi experimental model to assess the intervention group. To ensure group equivalence, prior achievement scores and classroom variables were analyzed (Ross & Morrison, 2003). Although the schools were purposefully selected, equivalence was established for experimental validity. The schools were selected based on prior achievement and attitude data and classroom-related variables to form the public and private groups. Which was clear flowing table. Pre-tests and post-tests measuring students' attitude scale were administered before and after the intervention to determine the effectiveness of the GSDL model on student outcomes.

Table 1:

Group Profiles on the basis of school types

School	Class	Students	Test type	Treatment	Test type
Public school	8	(28)	Pretest	GSDL model	Posttest
Private school	8	(28)	Pretest	GSDL model	Posttest

Implementation of the Guided Self-Directed Learning model

In this study, teachers implemented the GSDL model in mathematics classrooms, tailoring instructions to suit both the learning conditions and the mathematics content from the Grade 8 curriculum. Designed Pokhrel (2026) GSDL instruction model and developed lesson episodes used in this study was implemented comprised four key stages: preparatory, skill-gain, engagement, and committed in the intervention groups.

Data Collection Tools

This study adopts experimental research design aim to assess the effect of GSDL model on student's attitudes toward mathematics. Students attitudes toward mathematics scale was adopted from Pokhrel (2026), divided into three constructs: liking mathematics (4 items), valuing mathematics (4 items), and confidence in mathematics learning (4 items), Respondents rated each item using a five-point Likert scale: Strongly Agree (SA), Agree (A), Undecided (U), Disagree (D), and Strongly Disagree (SD), with scores ranging from 5 (SA) to 1 (SD).

The reliability and validity of the attitudes scales were established through expert judgment for face validity and the Cronbach's alpha method for internal consistency. A Cronbach's alpha with a range between 0.70 to 0.90 is considered to be acceptable (Alreshidi, 2016). In this

study, the Cronbach's alpha values for attitude scale were 0.86 falling within the acceptable range.

Data Analysis Techniques

All data collected from mathematics attitudes test and were analyzed through descriptive, inferential, and explanatory approaches. Moreover, independent t-tests and pair sample t test were used to compare groups and assess the effects of the GSDL model on attitudes toward mathematics. All quantitative data analyses were performed using IBM SPSS version 26 at a 5% level of significance. The data obtained from pre and post attitude test was analyzed by using SPSS and the result was inferred based on the research questions.

Comparison of Pre- and Posttest Results for the intervention group of private and public school

Now, the comparison of pre- and posttest results for attitudes toward mathematics is given in the tables below

Table 2:

Pair Sample Statistics of the Intervention group of The Private School for Attitudes towards Mathematics.

Pair	Group	Mean	S.D.	Sd.E	t-value	p-value	N
Pair-1	Pre-test Attitude: Liking Mathematics	2.53	0.591	0.112	-11.929	0.000*	28
	Post-test Attitude: Liking Mathematics	4.34	0.609	0.115			28
Pair-2	Pre-test Attitude: Place Value of Mathematics	3.45	0.963	0.182	-3.550	0.000*	28
	Post-test Attitude: Place Value of Mathematics	4.21	0.523	0.099			28
Pair-3	Pre-test Attitude: Confidence in Learning Mathematics	2.39	0.703	0.114	-5.548	0.000*	28
	Post-test Attitude: Confidence in Learning Mathematics	3.64	0.837	0.158			28
Pair-4	Total Attitude toward Mathematics (Pre-test)	2.76	0.568	0.107	-9.088	0.000*	28
	Total Attitude toward Mathematics (Post-test)	4.20	0.550	0.104			28

*P < 0.05

From tables 2, The implementation of the GSDL (Guided Self-Directed Learning) model significantly contributed to improving students' attitudes toward mathematics in private school intervention groups. The pre-test mean scores were below 3, indicating generally unfavorable attitudes but, the post-test mean scores were consistently above 3, demonstrating a shift toward more favorable attitudes. Moreover, for each of the paired components, the p-value was 0.000, which is less than the threshold of 0.05. This shows a statistically significant change from pre-test to post-test scores, reaffirming the positive impact of the GSDL model on students' attitudes in public schools.

Table 3:

Pair Sample Statistics of the intervention group of the Public School for Attitudes towards Mathematics

Pair	Group	Mean	S.D.	Sd.E	T value	Sign	N
Pair-1	Pre-test Attitude: Liking Mathematics	2.41	0.570	0.108	10.212	0.000*	28
	Post-test Attitude: Liking Mathematics	4.25	0.687	0.130			
Pair-2	Pre-test Attitude: Place Value of Mathematics	3.32	0.852	0.161	-5.378	0.000*	28
	Post-test Attitude: Place Value of Mathematics	4.49	0.728	0.138			
Pair-3	Pre-test Attitude: Confidence in Learning Mathematics	2.33	0.500	0.095	-6.880	0.000*	28
	Post-test Attitude: Confidence in Learning Mathematics	3.59	0.859	0.162			
Pair-4	Total Attitude toward Mathematics (Pre-test)	2.86	0.454	0.086	-11.92	0.000*	28
	Total Attitude toward Mathematics (Post-test)	4.25	0.441	0.083			

*P < 0.05

Similar to the results of table 2, the implementation of the GSDL (Guided Self-Directed Learning) model significantly contributed to improving students' attitudes toward mathematics in private and public school intervention groups. The pre-test mean scores were below 3, indicating generally unfavorable attitudes but, the post-test mean scores were consistently

above 3, demonstrating a shift toward more favorable attitudes. Obtaining similar result of p value, it reaffirms the positive impact of the GSDL model on students' attitudes in public schools.

Comparing the effect of the GSDL model on student's attitude of intervention groups in Public and Private Schools

The comparison of the impacts of the Guided Self-Directed Learning (GSDL) model on the experimental groups of public(government-funded) and private schools (independently managed), focusing on attitudes toward mathematics is mentioned in this section.

In this study, we wish to compare the mathematics attitudes between the experimental groups of both public and private schools. It is based in the schools where the GSDL model has been implemented. This comparative analysis determines the extent to which the GSDL approach influences students' attitudes in two different educational institutions.

Table 4:

The Comparison Between Experimental Group of Public and Private School

Component	Group	Mean	S.D.	Std. error	N
Pre attitude toward mathematics	Public	2.86	0.454	0.086	28
	Private	2.76	0.568	0.107	28
Post attitude toward mathematics	Public	4.25	0.491	0.083	28
	Private	4.20	0.556	0.104	28

For more description mention under table 5.

Table 5

Component	N	T -values	D.F.	p -value	Sig.
Pre attitudes toward Mathematics	28	0.7277	54	0.4699	Not Sig.
Post attitudes toward	28	0.3567	54	0.7227	

Means before the GSDL intervention

The study on the students' attitudes toward mathematics, the pretest means were 2.86 and 2.76 for public and private school students, respectively. Both of them were below the neutral midpoint of 3, indicating unfavorable attitudes. Hence there was no statistically significant difference between the two groups in their pretest attitudes toward mathematics.

Means after the GSDL intervention

The posttest means attitudes toward mathematics improved to 4.25 for public schools and 4.20 for private schools, both exceeded 3.0. This indicated a positive shift due to GSDL.

No significant difference was found between the groups, which shows that the GSDL model was equally effective in building positive attitudes toward mathematics. The findings reflected that the improvement in mathematics attitudes in both groups is due to GSDL model. For control variables, we have used standardized GSDL intervention, GSDL teacher training model, and used real classroom setting

During the intervention the teacher from both types of schools applied the GSDL model under the researcher's supervision, for similar teaching strategies and student engagement. Though there were some differences the benefits were the same. In terms of contrast, students from both school types increased confidence, engagement, and autonomy on account of GSDL adoption. Ultimately, all student from both types of schools were able to be benefitted by the GSDL model which comprised with the preparatory, Skill gain, engagement and committed stages.

Result of study

The study examined the effectiveness of the Guided Self-Directed Learning (GSDL) model on attitudes toward mathematics for Class 8 students in basic schools in Nepal. We have used experimental design to assess the impact of GSDL on attitudes toward mathematics. The following were the major findings of the study:

1. Total mean and S.D. of attitude toward mathematics in the pretest result were 2.76 and 0.56 respectively which is unfavorable but in the post test result were 4.20 and 0.55 which is favorable in private school.
2. There was significance difference of mean attitude toward mathematics between pre and post test result, showed that GSDL intervention had positive effect on student's overall attitudes toward mathematic in private school.
3. Total mean and S.D. of attitude toward mathematics in the pretest result for mean and standard deviation were 2.86 and 0.45 respectively which is unfavorable but in the post test result for mean and standard deviation were 4.25 and 0.44 which is favorable in public schools.
4. There was significance difference of mean attitude toward mathematics between pre and post test result, showed that GSDL intervention had positive effect on student's overall attitudes toward mathematic in public school.
5. There was no significance difference of mean attitude toward mathematics between private and public school in pretest result before the GSDL implementation within the similar baseline conditions. Similarly, the posttest also shows no significance difference of mean attitude toward mathematics between private and public school. After the GSDL model was implemented. Thus GSDL model was equally effective in improving attitudes toward mathematics in both private and public school.

Conclusion

This research is based on quantitative method under experiment design to find the effect of GSDL model on attitudes toward mathematics. We have used GSDL instructional model and mathematic attitudes scale designed by Pokhrel (2026). This study was set up in the context

of Nepal, where students often demonstrate indifference, passivity, and a lack of engagement in learning mathematics, which ultimately contributes to low achievement. To address this issue, the study used an innovative GSDL model aimed at enhancing student performance promoting learner autonomy. The result concludes that students in both school private and public had unfavorable attitude toward mathematics in pretest result but improved favorable attitude after GSDL intervention. There was significance difference of mean attitude toward mathematics between pre and post test result, showed that GSDL intervention had positive effect on student's overall attitudes toward mathematic in both private and public school. Thus it was seen that GSDL model was equally effective in improving attitudes toward mathematics in both private and public school. It is recommended to use new innovative guided self-directed instruction model designed by (Pokhrel, 2026) to all subjects apart from mathematics, levels and grade to promote positive learning attitude and learner autonomy for effective learning.

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Conflict of Interest

The authors declare no conflict of interest for the publication of this article.

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